

REMARKS

1) Applicants wish to point out that a replacement drawing for Fig. 1 is voluntarily provided, in order to correct certain typographical errors in the drawing. First, Settler 2 and Settler 3 are amended to now read Settler 1 and Settler 2, respectively. Further, the phrase "Ultra Turrax Inline Mixture" has been amended to simply read "Inline Mixture". Further, the phrase "Return to Reactor 1" has been amended to now read "Return to Transesterification Reactor". An arrow has been added toward Settler 1, which arrow represents the flow of "Ester from Transesterification". In addition, the features "1" and "2" have been replaced with their descriptors "Interphase" and "Heavy Phase". It is urged that these amendments have been made for purposes of clarification only, and no new matter is added.

The specification is amended accordingly at pages 4-5 as shown above, to reflect these corrections to Fig. 1. In the paragraph beginning on page 4, line 19 of the specification, the reference to Settler 2 has been changed to Settler 1, and the reactor 1 has been clarified as transesterification reactor 1. In the paragraph beginning on page 5, line 1 of the specification, the reference to Settler 3 has been changed to Settler 2.

2) The Examiner has rejected claim 1 under 35 U.S.C. 112, second paragraph, as being indefinite. Applicants respectfully submit that this ground of rejection has been overcome by the instant amendment. The Examiner has asserted that the word "fine" in the phrase "fine emulsion" is not defined by the claim and thus renders claim 1 indefinite. Applicants have removed the phrase "fine emulsion" from claim 1. It is respectfully asserted that the 35 U.S.C. 112 rejection has been overcome by the instant amendment, and that the rejection should be withdrawn.

3) The Examiner has rejected claims 1-3 under 35 U.S.C. 102 over EP 0249463 A2 (hereinafter EP '463) to Hoe Mun Lim. Applicants respectfully assert that this ground of

rejection should be withdrawn since the reference fails to teach each and every feature of the present claims.

The present invention relates to improved biodiesels formed from fats and oils, such as crude vegetable oils. More particularly, the present invention relates to a method for improving the long term stability of biodiesel. The claims, as amended above, require that a crude methyl ester is formed by transesterification of a vegetable or animal fat or oil with methanol. The formed crude methyl ester is intensively inline mixed at temperatures between 25 and 60°C with a strong acid or with a mixture of a strong acid and a complex former, to form an *emulsion*. Finally, an ester layer separated from the emulsion is subjected to a thorough water wash and is subsequently dried.

Applicants submit that these claimed steps are not shown in the cited art. Indeed, the cited reference EP '463 relates to bio-fuel production. However, it describes a process which *avoids* the formation of an emulsion, which goes against the present claims. EP '463 discloses a process which simply includes the following two steps: (1) reacting a crude triglyceride with an alcohol in the presence of a catalyst to form an alkyl ester, and (2) washing the product of step 1 with an aqueous wash to form an aqueous/organic phase system and wherein the catalyst is removed.

First, it is pointed out that EP '463 follows a traditional method of washing the crude ester phase after the transesterification step. This routine method includes mixing the phases but *avoiding* the formation of an emulsion. The traditional reason for this is due to the fear that the emulsion becomes too stable and will not break into the two original phases. Therefore EP '463 uses a mixing to form only droplets of one phase within the other phase (see column 2, lines 24-31). Additionally, to make sure that no emulsification occurs in the mixing tank, the wash preparation contains a surfactant and a strong salt solution to act as demulsifiers (see column 3, lines 30-33, and specifically lines 49-53). At column 4, lines 6 and 7, the reference explicitly states that there is no emulsifying. In direct contrast, the present invention departs from the traditional method of avoiding the formation of an emulsion. That is, in the present invention, an emulsion is *required* and is

*intentionally formed* by the use of intensive inline mixing apparatus. Applicants therefore submit that the presently claimed invention is patentably distinct from EP '463, which teaches away from the formation of an emulsion. It has been surprisingly found that the present method does not suffer from the traditional emulsion problems, i.e., that the emulsion will not break. Instead, after the breaking of the emulsion, there remains a stable interphase between washed ester phase and the heavy (wash) phase. It is therefore urged that the present invention is not only novel in view of the cited art, but it also possesses sufficient inventive step and is not at all obvious to the persons skilled in the art by reading the quoted state of art.

Furthermore, as shown above, the present claims require that the step of formation of crude methyl ester is conducted a temperature *between* 25 and 60°C. Examiner asserts that this step is anticipated by the cited art. Applicants urge that this is not the case. The present claims require a temperature within this range during the *formation step* of the crude methyl ester, which requires the presence of a strong acid or a mixture of a strong acid and a complex former. This step is conducted *prior to* the water wash step in the present invention. The Examiner states that cited reference discloses contacting their esterified oil with a phosphoric acid (strong acid) at 45°C. However, the only place in the citation where a 45°C temperature is discussed is during or after their *wash step* (see col.5, lines 20-26, see col. 6 lines 8-21). In fact, EP '463 specifically shows that the temperature during the formation of their crude triglyceride is at least 60°C (see col.4, lines 12-30, particularly lines 28-30). Thus, it is urged that since the cited reference does not teach every feature of the present claim 1, that the 35 U.S.C. 102 rejection cannot stand.

In addition, it is pointed out that column 6, lines 13 – 15 of EP '463 state that wash water is added and the mixture stirred gently for about 1 hour. It is urged that a gentle stirring creates only a relatively small number of relative big sized bubbles, whereas micelles created by emulsion increase dramatically the surface area between the ester phase and the aqueous phase. Thus, it can be concluded that the mixing effect and thus the removal of the impurities in EP '463 is far less efficient than the method of the present invention.

Lastly, it is urged that the addition of complex formers such as citric acid or EDTA in the present invention are new and inventive, in the sense that they chelate cations, which facilitates the removal of iron compounds as well as the removal of fatty acids.

Applicants further submit that the Examiner's comment in the first paragraph on page 4 is inaccurate. The referenced lines of EP '463 at column 6, lines 4 – 7 do not refer to the emulsion of the present invention, but to the *glycerol phase* which is formed when the oil reacts with methanol in the transesterification reaction (see column 5, line 62, to column 6, line 3). The present invention is not concerned with the glycerol phase but with the treatment and washing of the methyl ester phase of the transesterification reaction.

Applicants urge that the methods in the present invention differ significantly from the methods disclosed in the prior art in that the present invention developed a method with a specific aim to increase the long term stability of biodiesel by reducing the flocculation inducing "crystallization nuclei", which includes multivalent cations, residual soaps from fatty acids having multivalent cations, etc, whereas the methods of EP '463 focused on the production of biodiesel from natural resources in general.

For all of the above reasons, it is respectfully urged that the 35 U.S.C. 102 rejection should be withdrawn.

The undersigned respectfully requests re-examination of this application and believes it is now in condition for allowance. Such action is requested. If the Examiner believes there

is any matter which prevents allowance of the present application, it is requested that the undersigned be contacted to arrange for an interview which may expedite prosecution.

Respectfully submitted,



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